11-16-04

AF / 2623 / $
IFW

Atty. Dkt. No. 15-XZ-4974 (070191-0195)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Appellants: Richard Aufrichtig et al.

Title: CORRECTION OF DEFECTIVE PIXELS IN A DETECTOR

Appl. No.: 09/474,715

Filing Date: 12/29/1999

Examiner: Mehrdad Dastouri

Art Unit: 2623

CERTIFICATE OF EXPRESS MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service's "Express Mail Post Office To Addressee" service under 37 C.F.R. § 1.10 on the date indicated below and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

EV 505575380 US — 11/15/04
(Express Mail Label Number) (Date of Deposit)

Carolyn Simpson
(Printed Name)

Carolyn Simpson
(Signature)

TRANSMITTAL OF BRIEF ON APPEAL

Mail Stop APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Transmitted herewith is the following document for the above-identified application.

[X] Brief on Appeal Under 37 C.F.R. § 1.192 (40 pages)

[X] Please charge Deposit Account No. 07-0845 in the amount of $340.00 in payment of Appeal Fee.

[X] The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 07-0845. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 07-0845.

Please direct all correspondence to the undersigned attorney or agent at the address indicated below.

Respectfully submitted,

Date Nov. 15, 2004

By [signature]

FOLEY & LARDNER LLP
Customer Number: 33679
Telephone: (414) 297-5839
Facsimile: (414) 297-4900

Marcus A. Burch
Attorney for Applicant
Registration No. 52,673

Atty. Dkt. No. 15-XZ-4974 (070191-0195)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Appellants: Richard Aufrichtig et al.

Title: CORRECTION OF DEFECTIVE PIXELS IN A DETECTOR

Appl. No.: 09/474,715

Filing Date: 12/29/1999

Examiner: Mehrdad Dastouri

Art Unit: 2623

CERTIFICATE OF EXPRESS MAILING
I hereby certify that this correspondence is being deposited with the United States Postal Service's "Express Mail Post Office To Addressee" service under 37 C.F.R. § 1.10 on the date indicated below and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

EV 505575380 US (Express Mail Label Number) 11/15/04 (Date of Deposit)

Carolyn Simpson (Printed Name)

Carolyn Simpson (Signature)

BRIEF ON APPEAL

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Under the provisions of 37 C.F.R. § 1.192, this Appeal Brief is being filed together with a check in the amount of $340.00 covering the Rule 17(c) appeal fee. If this fee is deemed to be insufficient, authorization is hereby given to charge any deficiency (or credit any balance) to the undersigned deposit account 07-0845.

REAL PARTY IN INTEREST

This patent is assigned to GE Medical Systems Global Technology Company and involves GE Medical Systems.

RELATED APPEALS AND INTERFERENCES

None.

11/18/2004 MMEKONEN 00000073 09474715
01 FC:1402 340.00 OP

STATUS OF CLAIMS

Claims 1, 2, 4-11, and 13-81 are pending in the application. Claims 49 and 64 are objected to, but otherwise indicated as allowable. The remaining claims are rejected and being appealed.

STATUS OF AMENDMENTS

No amendments have been made after the most recent final rejection.

SUMMARY OF CITED ART AND CLAIMED SUBJECT MATTER

The present application relates to a method for correcting a defective pixel in an image produced by a detector.

The present application relates to digital image detectors such as solid state detectors. A solid state detector may contain a plurality of photodetector elements. For example, a radiographic x-ray detector can include several million photodetector elements to correspondingly provide an image having several million pixels. In such a detector, a certain number of pixels may be defective. Defective pixels often render values that are not representative of the subject being imaged. If the bad values of the defective pixels are left unaltered in the displayed image, those values would distract from the visualization of the rest of the image.

Due to the distracting character of the defective pixels, methods have been developed to, first, identify which pixels are defective and then to, second, correct the defective pixel. These two steps are generally done before the image is displayed. Some known methods used to perform the second step (correcting the defective pixel) replace each defective pixel value with an interpolation of its neighboring pixel values. Such correction methods, however, may be quite susceptible to creating image artifacts, such as breaks in guide wires, because the correction relies only on the defective pixel's surrounding pixels.

Cited References

Granfors

One system cited during prosecution is US Patent No. 5,657,400 to Granfors et al. (Granfors) which is assigned to General Electric Company. Granfors recognizes that some pixels in a detector will be defective and that this will cause poor visualization of the image. Col. 1, lines 52-55. To overcome this poor visualization, Granfors states that the goal of the second step, the correction process, is to find a value for the defective pixel that will "blend in" with neighboring pixels. Col. 4, lines 25-28 and Col. 1, lines 63-65.

The first step in the process (identifying the defective pixel) is taught by Granfors at Col. 3, line 29 to Col. 4, line 22. This process appears to include using a filter (e.g. a 5 x 5 filter) to identify pixels that sharply contrast with neighboring pixels. Col. 3, line 65 to Col. 4, line 11. On the basis of this filtering, Granfors will identify which pixels are defective.

Once defective pixels have been identified, Granfors teaches the second step in the process (correcting the defective pixel) at Col. 4, line 33 to Col. 5, line 7. For this second step, Granfors teaches assigning the defective pixel a correction value equal to the value of one of its neighbors or the average of the values of two of its neighbors. Col. 4, lines 33-35. The neighbor or neighbors used to provide the correction value for the defective pixel for each image is determined in a calibration procedure, which calibration procedure occurs before any of the images to be corrected are obtained. Col. 4, lines 54-60. Particularly, during the calibration procedure a code is stored for each defective pixel to identify which neighbor(s) are to be used to correct that defective pixel. Id. Later, during the process of obtaining an image of a subject of interest, Granfors teaches reading the code for the defective pixel from memory and using the values of the neighbor(s) corresponding to the stored code to provide the correction value for the defective pixel in the image of the subject of interest. Col. 4, line 66 to Col. 5, line 5.

The process used during the calibration phase to determine which code to store for a particular defective pixel is discussed at Col. 4, lines 41-50. The process involves determining which neighboring pixel or combination of neighboring pixels to use based on a predetermined selection order and based on which of the neighboring pixels is defective. Col.

4, lines 41-53. To help illustrate this, Fig. 3 is reproduced below. In Fig. 3, block 34 is the defective pixel and the other pixels are neighboring pixels:

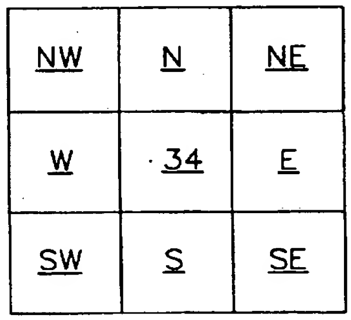


FIG. 3

Granfors teaches starting with pixels E & W. If neither E nor W is defective (if both are good pixels), then 34 is replaced by an average of the values of E & W. If at least one of E & W is defective, then the process moves on to pixels N & S. If neither N nor S is defective, then 34 is replaced by an average of the values of N & S. If at least one of N & S is defective the process moves on to the next set of pixels are performs the same tests. The order that the pixels are tested is E & W, N & S, NW & SE, NE & SW, N (alone, so 34 is replaced by the value of N), S, E, W, NE, NW, SE, SW.

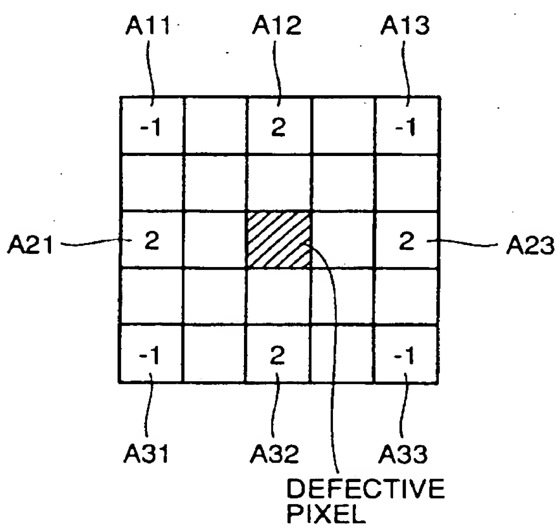
Watanabe

Another system cited during prosecution is U.S. Patent No. 5,854,655 to Watanabe et al. (Watanabe). Watanabe recognizes that some imaging systems may include pixels that are defective which pixels will degrade the quality of an image obtained from the system. Col. 1, lines 34-38. The primary objects of Watanabe appear to be an improved ability to detect defective pixels (i.e. to improve the first step). Col. 2, line 53 to Col. 3, line 2, and much of the remaining disclosure. Once a defective pixel is detected, a simple averaging is used to perform the second step of correcting the defective pixel. Col. 3, lines 58-62 and Col. 14, line 36 to Col. 8, line 5.

For the first step, the system of Watanabe monitors the input of its pixels during operation for pixels that appear defective. If a pixel is determined to be defective, the position/address of that pixel is written to memory.

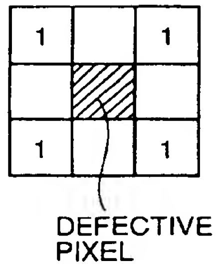
The system of Watanabe will perform the second step of correcting a defective pixel for a pixel that has been identified in memory as defective. Col. 14, lines 36-38. The pixels to use to provide values to correct the defective pixel are slecetd solely based on their position with respect to the defective pixel. If the defective pixel is red (R) or blue (B), a weighted average is taken of pixels A11 to A33 which are in predetermined positions with respect to the defective pixel as shown in Fig. 7 (reproduced below). Col. 14, lines 38-57.

FIG. 7



If the defective pixel is green (G), the values of the four pixels that are diagonal from and touch the corner of the defective pixel are averaged to correct the defective pixel as shown in Fig. 8 (reproduced below). Col. 15, lines 1-5.

FIG.8



Schreiner

US Patent No. 5,617,461 to Schreiner (Schreiner) was cited during a phone interview to bolster the reasoning behind rejection of some of the claims, but has not been used in a formal rejection. Schreiner recognizes that some pixels in an imaging system are defective and teaches that these pixels can be identified and corrected. Col. 1, lines 28-31. The main object of Schreiner is an improved method for identifying defective pixels. Col. 1, line 60 to Col. 2, line 56.

For completing the first step (identification), Schreiner recognizes that large size filters (e.g. 31 x 31 or 1 x 30) can be used. Col. 3, lines 31-40 and Col. 5, lines 8-17. For performing the second step (correction), on the other hand, Schreiner solely teaches using a linear interpolation of adjacent image points. Col. 3, lines 54-56; Col. 4, lines 48-50; and Col. 5, lines 23-24.

Present Claimed Inventions

The present application sets out to provide methods for performing the second step in a different manner than the conventional methods, which methods may tend to provide better results. Referring to the disclosure of the present application on pages 9 and 10 (and as illustrated by comparison of Figs. 8 and 9) a detector system whose pixels had been corrected according to an embodiment falling within the scope of the claims (Fig. 9) provides a better representation of the subject being imaged than does a system corrected by a conventional

correction method (Fig. 8) for at least the illustrated subject. The system of the application accomplishes this more accurate correction by incorporating features as specified in the claims.

A. Claims 1, 2, 9, 10, 11, 13-18, and 29-36

These claims are directed to methods and systems for correcting a defective pixel using information found in each of the pixels that neighbor the defective pixel. An example of a system according to these claims is discussed in the specification at pages 6, line 22 to page 9, line 12.

B. Claims 5, 14, 23, 33, 50, 65, and 78

These claims are directed to methods and systems for correcting a defective pixel by using gradient information relating to the various pixels of the system to select which pixels to use to provide the correction value for the defective pixel. The gradient information may include determining which pixels have the highest local gradient. In the specification, exemplary embodiments of these features are discussed at pages 6, line 22 to page 9, line 12. Particularly, an example of the "highest local gradient" feature of the claims is discussed in the specification starting at page 8, line 15.

C. Claims 8, 27, 28, 36, 46, 61, and 79

These claims are directed to methods and systems for correcting a defective pixel by calculating a local gradient using the defective pixel. In order to avoid relying heavily on the bad information found in the defective pixel, these claims temporarily replace the defective pixel with a temporary value that is used in the gradient calculation. An example of a system and method according to these claims is discussed in the specification at pages 6, line 22 to page 9, line 12. Particularly, an example of the "temporary value" feature is discussed in the specification at page 7, lines 3-8 and starting at page 8, line 3. This feature is also mentioned at page 9, lines 5-12.

D. Claims 19-28

Claim 19 has limitations which are written in a means plus function format and which should be interpreted under 35 U.S.C. § 112, sixth paragraph. These claims are directed to correcting a defective pixel. Examples of systems according to these claims are discussed in the specification at page 6, line 22 to page 9, line 12. The embodiments corresponding to the means for determining a local gradient are discussed in the specification of the present application with respect to step 46 of Fig. 3. The embodiments corresponding to the means for providing a correction value based on the local gradient are discussed in the specification of the present application with respect to step 48 of Fig. 3. Steps 46 and 48 can be found in the specification at page 6, line 22 to page 7, line 2 and at page 8, line 3 to page 9, line 4.

E. Claims 37-43

These claims are directed to a method for correcting a defective pixel using more global information found in an image from an x-ray detector. This more global information is used to provide a better representation of the defective pixel. Global information is defined more concretely in Claims 38 and 41-43. An example of a system according to these claims is discussed in the specification at page 6, line 22 to page 9, line 24. The "global characteristics" feature is particularly recited at page 8, lines 15-23.

F. Claims 44-48 and 50-63, and 65-81

These claims are directed to a method for correcting a defective pixel using information that can be more specific to the image being corrected. Unlike Granfors which uses the same pixels each time to correct the defective pixel, these claims are directed to systems which may change which pixels are used to correct the defective pixel from image to image. In this manner, the value of the defective pixel would not be based on predetermined pixels. In Claims 44-48 and 50-57 this is accomplished by analyzing characteristics of pixels and allowing the pixels used to be different for different images. In Claims 58-63 and 65-81

this is accomplished by analyzing an image to determine which pixel values to use to correct the defective pixel for that image.

Each of Claims 45-48, 50, 58, 60-63, 65, and 77-79 further recite that at least one characteristic analyzed to make the selection is a gradient of the various pixels or is one of edge strength, gradient strength, and image feature strength.

Claims 80 and 81 further differentiate from Granfors in that they further recite that a second image is obtained and that the second image is corrected based on at least a characteristic of the second image.

An example of a method according to these claims is discussed in the specification at page 6, line 22 to page 9, line 24. The feature showing that the pixels selected can be different for each image can be seen by reference to the specification at Figure 3, page 6 at lines 22-25, and the section starting at page 8, line 15. The fact that the characteristic can be a gradient or related to image features is discussed in the specification at page 8, lines 8-14.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Each rejected claim is rejected over U.S. Patent No. 5,657,400 to Granfors et al. either alone or as the primary reference. First, Claims 1, 2, 5, 8-11, 14, 17-21, 23, 26-31, 33, 36, 44-47, 50-52, 56, 57, 59-62, 65-67, 71, and 74-79 are rejected under 35 U.S.C. § 102(b) as being anticipated by Granfors. Second, Claims 4, 6, 13, 15, 22, 24, 32, 34, 37-43, 48, 63, 73, 80, and 81 are rejected under 35 U.S.C. § 103(a) as unpatentable over Granfors. Finally, Claims 7, 16, 25, 35, 53-55, 58, 68-70, and 72 are rejected under 35 U.S.C. § 103(a) as unpatentable over Granfors in view of U.S. Patent No. 5,854,655 to Watanabe et al.

ARGUMENT

BACKGROUND LAW

Some claims have been rejected under 35 U.S.C. § 102(b) as anticipated. The legal standards under 35 U.S.C. §102(a) are well-settled. The "basic test" for anticipation of a patent claim by a prior art reference is this: to establish anticipation, there must be "identity

of invention: the claimed invention, as described in appropriately construed claims, must be the same as that of the reference." Glaverbel S.A. v. Northlake Marketing & Supply, Inc., 45 F.3d 1550, 1554, 33 U.S.P.Q.2d 1496, 1498 (Fed. Cir. 1995); see also Continental Can Co. v. Monsanto Co., 948 F.2d 1264, 1267, 20 U.S.P.Q.2d 1746, 1748 (Fed. Cir. 1991). "The claimed invention is not anticipated under §102 unless each and every element of the claimed invention is found in the prior art." Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1379-80, 231 USPQ 81, 90 (Fed. Cir. 1986), cert. denied, 480 U.S. 947 (1987).

Some claims have been rejected under 35 U.S.C. §103(a) as obvious.[1] The legal standards under 35 U.S.C. § 103(a) are also well-settled. Obviousness under 35 U.S.C. § 103(a) is a legal conclusion involving four factual inquiries:

(1) the scope and content of the prior art;

(2) the differences between the claims and the prior art;

(3) the level of ordinary skill in the pertinent art; and

(4) secondary considerations, if any, of non-obviousness.

Litton Systems, Inc. v. Honeywell, Inc., 87 F. 3d 1559, 1567, 39 U.S.P.Q. 2d 1321, 1325 (Fed. Cir. 1996). See also Graham v. John Deere Co., 383 U.S. 1, 148 U.S.P.Q. 459 (1966).

In proceedings before the Patent and Trademark Office (PTO), the Examiner bears the burden of establishing a prima facie case of obviousness based upon the prior art. In re Piasecki, 745 F.2d 1468, 1471-72, 223 U.S.P.Q. 785, 787-88 (Fed. Cir. 1984). A prima facie case of obviousness requires that the prior art reference or references teaches or suggests all of the claimed limitations. In re Royka, 490 F.2d 981, 180 U.S.P.Q. 580 (CCPA 1974); Manual of Patent Examining Procedure (MPEP), Edition 8, August 2001, Sections 2142, 2143.03. "The Examiner can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would

[1] "A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made." 35 U.S.C. §103(a).

lead that individual to combine the relevant teachings of the references. In re Fritch, 972 F.2d 1260 (Fed. Cir. 1992); In re Fine, 837 F.2d 1071, 1074 (Fed. Cir. 1988); In re Lalu, 747 F.2d 703,705, 223 U.S.P.Q. 1257, 1258 (Fed. Cir. 1984); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 297 n.24, 227 U.S.P.Q. 657, 667 n.24 (Fed. Cir. 1985); ACS Hospital Systems, Inc. v. Montefiore Hospital, 782 F.2d 1572, 1577, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984). When a reference teaches away from the claimed invention, that teaching is strong evidence of non-obviousness. See U.S. v. Adams, 383 U.S. 39, 148 U.S.P.Q. 79 (1966); In re Royka, 490 F. 2d 981, 180 U.S.P.Q. 580 (CCPA 1974).

As noted by the Federal Circuit, the "factual inquiry whether to combine references must be thorough and searching." McGinley v. Franklin Sports, Inc., 262 F.3d 1339, 60 USPQ.2d 1001 (Fed. Cir. 2001). Further, it "must be based on objective evidence of record." In re Lee, 277 F.3d 1338, 61 USPQ.2d 1430 (Fed. Cir. 2002). The teaching or suggestion to make the claimed combination must be found in the prior art, and not in the applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ.2d 1438 (Fed. Cir. 1991). The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. In re Mills, 916 F.2d 680, 16 USPQ.2d 1430 (Fed. Cir. 1990). "It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to '[use] that which the inventor taught against its teacher.'" Lee (citing W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983)).

REJECTIONS

Granfors is used as the primary reference to reject each claim. In some instances, Granfors is used alone and in others it is used in combination with Watanabe. Each claim recites at least one feature not taught or suggested by Granfors or by the combination of Granfors and Watanabe.

A. Claims 1, 2, 9, 10, 11, 13-18, 29-36

Claims 1, 2, 9, 10, 11, 13-18, and 29-36 are rejected under 35 U.S.C. § 102(b) as anticipated by US Patent No. 5,657,400 to Granfors et al. (hereinafter Granfors). Anticipation

requires that each element recited in the claim be taught by the cited reference. These claims recite at least one element not taught by Granfors; the claims recite providing a correction value based on each surrounding neighboring pixel of the defective pixel. Thus, these claims are not anticipated by Granfors.

Applicants respectfully disagree with the opposite conclusion reached in the Office Action issued for this case. Granfors teaches using a subset of neighboring pixels (2 of 8 neighbors or 1 of 8 neighbors) to provide the correction value, and not each surrounding neighboring pixel (e.g. 8 of 8 neighbors) as is claimed.

Claim 1 (representative of the group) recites providing a correction value based on the local gradient comprising an array of local gradient matrix elements "wherein at least a portion of the array of pixel values comprises a matrix, and includes the defective pixel as a center matrix element and each surrounding neighboring pixel of the defective pixel as additional matrix elements" (underline added). Granfors does not teach providing a correction value based on a matrix including each surrounding neighboring pixel of the defective pixel as additional matrix elements in combination with the other elements of Claim 1. Rather, Granfors teaches providing a correction value for a defective pixel using a "matrix" which includes only two (at most) of the eight pixels which neighbor and surround the defective pixel. Col. 4, lines 41-46. Further, while not discussed in Granfors, even if the defective pixel of Granfors were a corner pixel, the method taught in Granfors would at most use two of the three neighboring pixels. Since Granfors fails to teach at least this element recited in Claim 1, rejection of Claim 1 as anticipated by Granfors is improper.

In contrast to this, the Office Action argues that Granfors does teach using each surrounding neighboring pixel of the defective pixel as additional matrix elements. Specifically, the Office Action states "(in this case two pixels)." See e.g. Paper 11, page 3. As can be seen by reference to Granfors at Col. 4, lines 41-46 and Fig. 3, the defective pixel (34) has eight neighboring pixels – N, NE, E, SE, S, SW, W, NW – only two of which are used (the others being eliminated from use during a calibration procedure that occurs before an image is obtained). Col. 4, line 54 to Col. 5, line 7. The two pixels used do not constitute

each pixel that surrounds the defective pixel; there are pixels that are not used. Thus, Granfors does not teach at least this element of Claim 1 and does not anticipate Claim 1.

Claims 10 and 29 recite elements similar to Claim 1 and should be found allowable for reasons similar to Claim 1. Claims 2 and 4 depend from Claim 1, Claims 11 and 13-18 depend from Claim 10, and Claims 30-36 depend from Claim 29. These claims should be found allowable for at least the same reasons as the claim from which they depend.

B. Claim 5, 14, 23, 33, 50, 65, and 78

Claims 5, 14, 23, 33, 50, 65, and 78 are rejected under 35 U.S.C. § 102(b) as anticipated by US Patent No. 5,657,400 to Granfors et al. Anticipation requires that each element recited in the claim be taught by the cited reference. Claims 5, 14, 23, 33, 50, 65, and 78 recite at least one element not taught by Granfors; these claims generally recite selecting pixels for providing a correction value based on a determination that they had the highest local gradient. Thus, Claims 5, 14, 23, 33, 50, 65, and 78 are not anticipated by Granfors.

Applicants respectfully disagree with the opposite conclusion reached in the Office Action. While the system of Granfors *may* end up using values of pixels having the highest local gradient to provide the correction value, the system of Granfors makes no determination that the pixels have the highest local gradient, as claimed.

Claim 5 (representative of the group) recites "wherein step (b) of providing a correction value includes at least one of a linear interpolation and a weighted average of pixel values corresponding to pixels selected based on a <u>determination</u> that they had the highest local gradient" (underline added). Granfors does not teach using pixel values corresponding to pixels selected based on a <u>determination</u> that they had the highest local gradient as recited in Claim 5. Rather, Granfors teaches using pixel values that pass the simple test recited in Granfors; two pixels opposite each other (E&W, N&S, etc.) that neighbor the defective pixel are selected in a predetermined order so long as neither pixel of the pair is defective. Col. 4, lines 38-53. This simple test used in Granfors does not involve a determination that selected

pixels had the highest local gradient. Thus, Granfors fails to disclose at least this element recited in Claim 5, and rejection of Claim 5 as anticipated by Granfors is improper.

The Office Action concludes that Granfors does teach this element of Claim 5. The Office Action reasons that pixels having the highest gradients will inevitably be those neighboring the defective pixel and Granfors teaches using pixels neighboring the defective pixel, thus a system according to Granfors would inevitably use the highest local gradient elements. See e.g. Paper 11, page 3. Applicants submit that Claim 5 requires that pixels be selected based on a <u>determination</u> that they had the highest local gradient. As discussed in the previous paragraph, Granfors makes no such determination. The fact that the pixels having a highest gradient *may* end up being used does not mean that Granfors teaches making a determination that the pixels have the highest local gradient, as is claimed in Claim 5. For example, Granfors is unconcerned with whether pixels E and W have higher gradients than pixels N and S (all four of which border the defective pixel, and by the logic of the Office Action would be equally as likely to have the highest local gradients). Thus, Granfors fails to teach "wherein step (b) of providing a correction value includes … [using] pixel values corresponding to pixels selected based on a determination that they had the highest local gradient" as claimed in Claim 5, and the reasoning supplied in the Office Action does not make up for this deficiency. Thus, rejection of Claim 5 as anticipated by Granfors is improper.

Claims 14, 23, 33, 50, 65, and 78 recite elements similar to Claim 5 and would be allowable over Granfors for reasons similar to those discussed for Claim 5.

C. Claim 8, 27, 28, 36, 46, 61, and 79

Claims 8, 27, 28, 36, 46, 61, and 79 are rejected under 35 U.S.C. § 102(b) as anticipated by US Patent No. 5,657,400 to Granfors et al. Anticipation requires that each element recited in the claim be taught by the cited reference. Claims 8, 27, 28, 36, 46, 61, and 79 recite at least one element not taught by Granfors; these claims recite temporarily replacing the value of the defective pixel with a temporary value. Thus, Claims 8, 27, 28, 36, 46, 61, and 79 are not anticipated by Granfors.

Applicants respectfully disagree with the opposite conclusion reached in the Office Action. The system described by the Office Action as taught by Granfors and used by the Office Action to reject these claims is not a system taught by Granfors, nor is it based on inherent features of the system of Granfors.

Claim 8 (representative of the group) recites "replacing the defective pixel with a temporary value ... such that determining the local gradient comprises determining the local gradient using the temporary value of the defective pixel." Granfors does not teach replacing the defective pixel with a temporary value such that determining the local gradient comprises determining the local gradient using the temporary value of the defective pixel. Rather, Granfors only ever replaces the value of the defective pixel with the final correction value – that is, with the average of the two non-defective neighboring pixels. Col. 5, lines 1-5. Thus, Granfors fails to teach at least one element recited in Claim 8, and rejection of Claim 8 as anticipated by Granfors is improper.

The Office Action reasons that since Granfors cycles through pairs of neighboring values until it finds a pair that is usable to correct the defective pixel, any time the first pair is not used, the defective pixel must have been replaced by a temporary value from the first pair which did not work. Paper 11, pages 3-4. Granfors does not teach such a system. Rather, instead of cycling through pairs of neighboring values until it finds a pair that is usable, Granfors teaches identifying the usable pair during a calibration phase. Col. 4, lines 54-67. Granfors does not teach replacing the defective pixel with any values during the calibration phase. Id. Thus, the system used to reject these claims is not taught in Granfors.

Further, to the extent the Office Action is attempting to assert that the "temporarily replacing" feature is inherent in Granfors, Applicants respectfully disagree. Granfors teaches that the usable pair of pixels is selected in a calibration phase and a code corresponding to that pair is stored in memory. Col. 4, lines 54-65. Then, in the imaging phase, the code stored in memory is read from memory and the pair of pixels corresponding to the code is the only pair used to calculate a correction value. Col. 4, line 66 to Col. 5, line 5. Thus, the only time that more than one pair of pixels is involved is during initial calibration. Since no values appear to be calculated during the initial calibration phase and since no values are needed in

the initial calibration phase to select which pair to use in Granfors, it would not be inherent in Granfors that the defective pixel be temporarily replaced by a temporary value as argued by the Office Action.

The system used by the Office Action to reject Claim 8 is not the system taught by Granfors nor is it an inherent feature of the system of Granfors. Further, as discussed above, the system recited in Granfors fails to teach at least this element of Claim 8. Thus, rejection of Claim 8 as anticipated by Granfors is improper.

Claims 27, 28, 36, 46, 61, and 79 recite elements similar to those recited by Claim 8 and rejection of these claims as anticipated by Granfors is improper for reasons similar to those discussed for Claim 8.

D. Claims 19-21, 23, and 26-28

Claims 19-21, 23, and 26-28 are rejected under 35 U.S.C. § 102(b) as anticipated by US Patent No. 5,657,400 to Granfors et al. Anticipation requires that each element recited in the claim be taught by the cited reference. Claims 19-21, 23, and 26-28 recite at least one element not taught by Granfors; these claims recite means for providing a correction value based on the local gradient. Thus, Claims 19-21, 23, and 26-28 are not anticipated by Granfors.

Claim 19 recites "means for providing a correction value based on the local gradient" which corresponds to step 48 of the present application. The embodiments of step 48 are directed to "providing a correction value based on the local gradient" by using the local gradient to select which pixels to use to correct the defective pixel. Granfors does not teach using the local gradient to select pixels to use to correct the defective pixel nor does Granfors teach an equivalent to this element. Rather, the "local gradient" identified in the Office Action is the linear average of the two neighboring pixel values. This "local gradient" is used to directly provide the correction value, and not to select pixels to use to provide the correction value. Since Granfors fails to teach at least one element recited in Claim 19, rejection of Claim 19 as anticipated by Granfors is improper.

Claims 20, 21, 23, and 26-28 depend form Claim 19 and are not anticipated by Granfors for at least the same reasons as Claim 19.

E. Claims 37-43

Claim 37 was rejected under 35 U.S.C. § 103(a) as unpatentable over US Patent No. 5,657,400 to Granfors et al. Unpatentability under § 103(a) requires that one of ordinary skill in the art would have been motivated to modify Granfors in the manner such that it would teach all of the elements recited in the rejected claims. Granfors does not teach "analyzing global characteristics of pixels in proximity to the defective pixel; and correcting the defective pixel based on the global characteristics." Further, one of ordinary skill in the art would not have been motivated to modify Granfors to arrive at a device as recited in Claim 37. Thus, Claim 37 is not obvious in view of Granfors.

Applicants respectfully disagree with the opposite conclusion reached in the Office Action. The motivation to modify Granfors must come from objective evidence (e.g. the references themselves) or from the general nature and skill in the art. The motivation recited in the Office Action is not found in any of the references cited during prosecution. Further, it appears that the motivation recited in the Office Action is based on principles that are too generic to specifically motivate one of skill in the art to modify Granfors in a manner that would render Claim 37 obvious. Further still, the cited motivation appears to be contradicted by objective evidence found in the patents cited in the Office Action, including Granfors and Schreiner.

Claim 37 recites "analyzing global characteristics of pixels in proximity to the defective pixel; and correcting the defective pixel based on the global characteristics." Granfors does not teach correcting the defective pixel based on the global characteristics of pixels in proximity to the defective pixel. Rather, Granfors teaches correcting the defective pixel based on a simple linear average of two neighboring pixels.

Further, sufficient motivation has not been shown to modify Granfors in a manner that would include a system that analyzed global characteristics of pixels in proximity to the defective pixel and corrected the defective pixel based on the global characteristics. There is

no express teaching or motivation provided in Granfors to modify the system of Granfors to correct the defective pixel based on the global characteristics of pixels. Thus, the motivation to modify Granfors would need to come from the general nature and skill in the art. The Office Action states that larger filter kernels are well known and that "it would have been obvious… to select … [these] kernels because these are well known filter kernels conventionally utilized in image processing for filtering purposes to detect and enhance the features in digital images." See e.g. Paper 11, pages 4 and 15.

Applicants respectfully disagree that mere knowledge of the existence of these filters and their use in image processing, generically, would motivate one of ordinary skill in the art to use such a filter to correct a defective pixel as claimed. The mere general knowledge that such filters may be used does not mean that one of ordinary skill in the art would have been motivated to use such filters in a manner claimed in Claim 37.

For the claimed subject matter of these claims, Applicants' position is supported by reference to the patents cited by the Office Action (e.g. Granfors and Schreiner), which tend to contradict the assertion by the Office Action that one of skill in the art would have been motivated to use these filters to correct a defective pixel. The patents cited recognize the existence and use of these types of filters in imaging systems, but, unlike the assertion made in the Office Action, were not motivated by this knowledge to teach or suggest using these filters to correct a defective pixel as is claimed in these claims. For example, Granfors teaches using these larger filters to identify which pixels are defective (i.e. recognizing their existence and usability). Col. 4, lines 1-11. But Granfors, when teaching how to correct a defective pixel, does not teach or suggest using these filters. Col. 4, line 38 to Col. 5, line 7. Instead, Granfors teaches using a method involving a linear interpolation of two neighboring pixels. Likewise, Schreiner, cited by the examiner during a phone interview, teaches using larger filters to identify which pixels are defective. Col. 3, lines 31-37 and Col. 5, lines 8-17. Schreiner likewise, when teaching how to correct the defective pixels, does not teach or suggest using these filters. Col. 3, lines 54-56; Col. 4, lines 48-50; and Col. 5, lines 23-24. Instead, Schreiner teaches using a linear interpolation of neighboring pixels. Thus, the cited patents, despite being aware of the existence of these filters and their usability in imaging systems, were not motivated to use such filters to correct a defective pixel.

Since the motivation proposed by the Office Action is not found in any of the cited references and is, instead, only based on the Office Action's assertion of the general nature of skill in the art, and since the proposed motivation appears not to have motivated at least two sets of inventors who have patents in the art, sufficient motivation to modify Granfors in a manner that would obviate Claim 37 has not been shown. What was done by the cited references themselves when presented with the knowledge relied on by the Office Action to establish obviousness is a better indication of what motivations were present in the general nature and skill in the art than a mere assertion of the general nature and skill in the art made in an Office Action. Since sufficient motivation has not been shown to modify Granfors in a manner that would teach each of the elements of Claim 37, finding Claim 37 unpatentable as obvious under § 103(a) is improper.

Claims 38-43 depend from Claim 37 and would be allowable for at least the same reasons as Claim 37.

Claims 38 and 41-43 recite further elements that specify particular pixels that need to be analyzed as part of the analysis of the global characteristics, which further elements are likewise not taught or suggested by the cited references and provide further grounds for patentability of those claims.

F. Claims 44 and 51-57

Claims 44, 51, 52, 56, and 57 have been rejected as anticipated and Claims 53-55, which depend from Claim 44, have been rejected as obvious.

1. Anticipation

Claims 44, 51, 52, 56, and 57 were rejected under 35 U.S.C. § 102(b) as anticipated by US Patent No. 5,657,400 to Granfors et al. Anticipation requires that each element recited in the claim be taught by the cited reference. Claim 44 recites at least two elements not taught by Granfors. Thus, Claim 44 is not anticipated by Granfors. Applicants respectfully disagree with the opposite conclusion reached in the Office Action, particularly given that the Office Action is silent as to where at least one of these elements is taught in Granfors.

First, Claim 44 recites "providing a pixel value for the defective pixel using the first, second, and third pixel values." Granfors does not teach providing a pixel value for a defective pixel using three pixel values. Rather, Granfors teaches averaging a pair of pixel values from up to two neighboring pixels (the remaining pixel values of neighboring pixels being unused). Thus, Granfors fails to teach this first element of Claim 44.

Second, Claim 44 further recites "wherein the first pixel, the second pixel, and the third pixel selected may be different for each image." Granfors does not teach that the pixels used to provide a pixel value for the defective pixel may be different for each image. Rather, Granfors teaches that the pixels whose pixel values will be used to correct the defective pixel are predetermined in a calibration phase and will be common to all images. Col. 4, line 54 to Col. 5, line 5. The Office Action is silent as to where it believes that this element is taught in Granfors. See e.g. Paper 11, at pages 5 and 10.

Since Granfors fails to teach at least one element recited in Claim 44, rejection of Claim 44 as anticipated by Granfors is improper. Claims 51, 52, 56, and 57 depend from Claim 44 and rejection of these claims as anticipated by Granfors is improper for at least the same reasons as Claim 44.

2. Obviousness

Claims 53-55 were rejected under 35 U.S.C. § 103(a) as unpatentable over Granfors in view of US Patent No. 5,854,655 to Watanabe et al. (hereinafter Watanabe). Claims 53-55 depend from Claim 44. Due to this dependency, obviousness of Claims 53-55 requires that Granfors, Watanabe, or the combination thereof teach or suggest every element recited in Claim 44. Both of Granfors and Watanbe fail to teach or suggest the same element of Claim 44 and nothing in the combination of Granfors and Watanabe would suggest the inclusion of the element not taught by either reference individually.

Applicants respectfully disagree with the opposite conclusion reached in the Office Action. The Office Action incorrectly assumes that Granfors teaches the element that is, in fact, not taught by either Granfors or Watanabe.

As discussed above, Claim 44 recites "providing a pixel value for the defective pixel using the first, second, and third pixel values; wherein the first pixel, the second pixel, and the third pixel selected may be different for each image." As discussed above, Granfors fails to teach this element of Claim 44. Likewise, Watanabe fails to teach providing a pixel value for the defective pixel where the pixels used to provide the correction value for a defective pixel may be different for each image. Rather, Watanabe teaches that for each image, the pixels used to correct a particular defective pixel are always the same. See Col. 14, lines 36-42 and Col. 15, lines 1-5.

Nothing in Granfors or Watanabe, which references both teach using the same pixels in each image to correct the defective pixel, would motivate one of skill in the art to add this element of Claim 44 which is not taught in or suggested by either reference individually. Additionally, the Office Action is silent on where this element is found in the prior art or why someone of ordinary skill in the art would be motivated to provide this element of Claim 44 not taught in either reference. See e.g. paper 11 at pages 5, 10, and 15-16.

Since neither reference individually teaches or suggests at least this element and since the combination of references do not teach or suggest at least this element of Claim 44, rejection of Claim 44 as obvious over Granfors in view of Watanabe would be improper. Since Claims 53-55 depend from Claim 44, rejection of these claims as obvious over Granfors in view of Watanabe is improper for at least the same reasons as for Claim 44.

G. Claims 59-63 and 65-81

Claims 59-62, 65-67, 71, 74, and 75-79 have been rejected as anticipated and Claims 63, 68-70, 72, 73, 80, and 81, which each depend from Claim 76, have been rejected as obvious.

1. Anticipation

Claims 59-62, 65-67, 71, 74, and 75-79 were rejected under 35 U.S.C. § 102(b) as anticipated by US Patent No. 5,657,400 to Granfors. Anticipation requires that each element recited in the claim be taught by the cited reference. These claims recite at least one element not taught by Granfors. Thus, these claims are not anticipated by Granfors.

Claim 76 recites "selecting which values to use to provide a value for the defective pixel for the first image based on a characteristic of the first image." Granfors does not teach selecting which values to use to provide a value for the defective pixel for the first image based on a characteristic of the first image. Rather, Granfors teaches selecting which pixels to use in a calibration phase that occurs before an image to be corrected is obtained. Col. 4, line 54 to Col. 5, line 5.

Since Granfors fails to teach at least one element of Claim 76, rejection of Claim 76 as anticipated by Granfors is improper. Claims 77-79 depend from Claim 76 and rejection of these claims is improper for at least the same reasons as Claim 76.

2. Obviousness

Claims 63, 73, 80, and 81 are rejected under 35 U.S.C. § 103(a) as being unpatentable over US Patent No. 5,657,400 to Granfors, and Claims 68-70 and 72 are rejected under 35 U.S.C. § 103(a) as unpatentable over US Patent No. 5,657,400 to Granfors in view of US Patent No. 5,854,655 to Watanabe. Claims 53-55 depend from Claim 44. Due to this dependency, obviousness of Claims 53-55 requires that Granfors, Watanabe, or the combination thereof teach or suggest every element recited in Claim 44. Both of Granfors and Watanbe fail to teach or suggest the same element of Claim 44 and nothing in the combination of Granfors and Watanabe would suggest the inclusion of the element not taught by either reference individually.

Applicants respectfully disagree with the opposite conclusion reached in the Office Action. The Office Action incorrectly assumes that Granfors teaches the element that is, in fact, not taught by either Granfors or Watanabe.

As discussed above, Claim 76 recites "selecting which values to use to provide a value for the defective pixel for the first image based on a characteristic of the first image." As also discussed above, Granfors fails to teach this element of Claim 76. Likewise, Watanabe fails to teach selecting which values to use to provide a value for the defective pixel for the first image based on a characteristic of the first image. Rather, Watanabe teaches

that for each image, the pixels used to correct a particular defective pixel are always the same. See Col. 14, lines 36-42 and Col. 15, lines 1-5.

Nothing in Granfors or Watanabe, which references both teach using the same pixels in each image to correct the defective pixel, would motivate one of skill in the art to add this element of Claim 44 which is not taught in or suggested by either reference individually. Additionally, the Office Action is silent on where this element is found in the prior art or why someone of ordinary skill in the art would be motivated to provide this element of Claim 76 not taught in either reference. See e.g. paper 11 at pages 5 and 9-17.

Since neither reference individually teaches or suggests at least this element and since the combination of references do not teach or suggest at least this element of Claim 76, rejection of Claim 76 as obvious over Granfors or over Granfors in view of Watanabe would be improper. Since Claims 63, 68-70, 72, 73, 80, and 81 depend from Claim 76, rejection of these claims as obvious over Granfors or over Granfors in view of Watanabe is improper for at least the same reasons as for Claim 76.

H. Claims 45-48, 50, 60-63, and 65

Claims 45-48 and 50 depend from Claim 44 and have been rejected over common references. To the extent that Claim 44 is found allowable over these references, Claims 45-48 and 50 should also be found allowable. Claims 60-63, and 65 depend from Claim 76. To the extent that Claim 76 is found allowable, Claims 60-63 and 65 should also be found allowable.

Claims 45-47, 50, 60-62, and 65 were rejected as anticipated by Granfors and Claims 48 and 65 were rejected as obvious in view of Granfors.

1. Anticipation

Claims 45-47, 50, and 60-62 were rejected under 35 U.S.C. § 102(b) as anticipated by US Patent No. 5,657,400 to Granfors et al. Anticipation requires that each element recited in the claim be taught by the cited reference. These claims recite at least one element not taught by Granfors in addition to those elements discussed above with respect to Claim 44 or Claim 76. Thus, these claims are not anticipated by Granfors. Applicants respectfully disagree with

the opposite conclusion reached in the Office Action; the sections of Granfors cited by the Office Action to make the rejection do not teach at least one element of the claim.

Claim 45 (representative of the group) recites that three pixels are selected to provide a correction value for a defective pixel based on an analyzed characteristic of each pixel "wherein the analyzed characteristic comprises a gradient of the pixel being analyzed." Granfors does not teach selecting a pixel (to be used in providing a pixel value for the defective pixel) based on a gradient of the pixel. Rather, Granfors teaches selecting a pixel based on a predetermined selection order and based on whether the pixel is itself defective. See Col. 4, lines 41-53.

The Office Action reasons that this element is shown at Col. 4, lines 1-11 and 38-53 of Granfors. See paper 11 at page 10. Granfors at Col. 4, lines 1-11 is directed to the first step of identfiying which pixels are defective and is not directed to selecting a pixel to use to provide a correction value for a defective pixel (as is claimed). Granfors at Col. 4, lines 38-53 is directed to selecting pixels to provide a correction value based on the simple method discussed above. Neither of these sections teaches selecting pixels to provide a correction value for a defective pixel based on an analyzed characteristic of each pixel where the analyzed characteristic is a gradient of the pixel being analyzed.

Since Granfors fails to teach at least one element recited in Claim 45, rejection of Claim 45 as anticipated by Granfors is improper. Claims 46, 47, and 50 depend from Claim 45, and rejection of these claims as anticipated by Granfors is improper for at least the same reasons.

Claim 60 recites elements similar to those discussed for Claim 45 and rejection of Claim 60 is improper for reasons similar to those discussed for Claim 45. Claims 61, 62, and 65 depend from Claim 60, and rejection of these claims as anticipated by Granfors is improper for at least the same reasons.

Further, Claims 45-47 and 50 depend from Claim 44 and are not anticipated by Granfors for at least the reasons discussed above for Claim 44. Claims 60-62 and 65 depend

from Claim 76 and are not anticipated by Granfors for at least the reasons discussed above for Claim 76.

2. Obviousness

Claims 48 and 63 were rejected under 35 U.S.C. § 103(a) as unpatentable over Granfors. Claim 48 depends from Claim 45 and Claim 63 depends from Claim 60. Due to this dependency, obviousness of Claims 48 and 63 over Granfors would also require that Claims 45 and 60 (respectively) be obvious over Granfors. Obviousness requires that every element be taught or suggested by the cited reference. Granfors fails to teach or suggest at least one element of Claims 45 and 60 and so does not obviate Claim 45, 48, 60, or 63.

As discussed above, Granfors fails to teach that three pixels are selected to provide a correction value for a defective pixel based on an analyzed characteristic of each pixel "wherein the analyzed characteristic comprises a gradient of the pixel being analyzed" as recited in Claim 45 (representative of the group). Further, nothing in Granfors suggests this element. Rather, Granfors teaches selecting which pixels to use to correct the defective pixel in the calibration phase based only on a predetermined selection order and based on which neighboring pixels are defective. Col. 4, lines 41-53. Further still, the Office Action does not assert that this element is suggested by Granfors. Rather, the Office Action incorrectly assumes, as discussed above, that this element is taught by Granfors.

Since Granfors fails to teach or suggest at least one element recited in Claim 45, rejection of Claim 45 as obvious over Granfors would be improper. Claim 48 depends from Claim 45, and rejection of Claim 48 as obvious over Granfors is improper for at least the same reasons as for Claim 45. Similar arguments are applicable to Claims 60 and 63 which recite elements similar to those discussed for Claim 45.

I. Claim 58

Claim 58 depends from Claim 44 and has been rejected over common references as Claim 44. To the extent that Claim 44 is found allowable over these references, Claim 58 should also be found allowable.

Claim 58 was rejected under 35 USC § 103(a) as unpatentable over US Patent No. 5,657,400 to Granfors in view of US Patent No. 5,854,655 to Watanabe et al. Obviousness under § 103(a) requires that the references teach or suggest, alone or in combination, all of the elements of the rejected claim. Each of Granfors and Watanabe fails to teach or suggest at least one element of Claim 58 and nothing in the combination of these references teaches or suggests the element not taught by the references individually. Applicants respectfully disagree with the opposite conclusion reached in the Office Action; the process identified in the cited references by the Office Action does not operate in the manner claimed in Claim 58.

Claim 58 recites that three pixels are selected to provide a correction value for a defective pixel based on an analyzed characteristic of each pixel where "the characteristic analyzed comprises a characteristic selected from a group consisting of edge strength, gradient strength, and image feature strength." Granfors does not teach or suggest that pixels are selected to provide a correction value based on an analysis of their edge strength, gradient strength, or image feature strength. Rather, Granfors teaches that a pixel is selected to provide a correction value based on a predetermined selection order and whether earlier pixels in the order are defective. Col. 4, lines 41-53.

Watanabe likewise fails to teach or suggest that pixels are selected to provide a correction value based on an analysis of their edge strength, gradient strength, or image feature strength. Rather, Watanabe teaches using the same pixels to provide a correction value every time, without any need to analyze the pixels. Col. 14, lines 38-57 and Col. 15, lines 1-5.

Further, nothing in the combination of Granfors and Watanabe suggests this element which is not present in either reference individually.

The Office Action reasons that "[r]egarding Claim 58, it is further submitted that the results of the applied filtering by prior arts of record are the edge and gradient strength, which are further utilized in defective pixel correction." Applicants respectfully disagree that any filtering taught in Granfors or in Watanabe are utilized in the correction of the defective pixel. The only filtering that appears to be done by Watanabe and Granfors is filtering to identify the

defective pixels (i.e. the first step). See, e.g. Granfors at Col 3, line 65 to Col. 4, line 11. This filtering is not used in either reference to analyze and select a first pixel, a second pixel, and a third pixel for use in providing a correction value for a defective pixel. Rather, as mentioned in the previous paragraph, Granfors uses a predetermined selection order based on which pixels are defective, and Watanabe uses predetermined pixels without ever analyzing the pixels.

Also, Claim 58 depends from Claim 44 and is not rendered obvious by Granfors in view of Watanabe for at least the reasons discussed above for Claim 44.

Since Granfors, Watanabe, and the combination of those two patents all fail to teach or suggest at least one element recited in Claim 58, rejection of Claim 58 as obvious is improper.

J. Claims 80 and 81

Claims 80 and 81 depend from Claim 76 so to the extent that Claim 76 is allowable, Claims 80 and 81 should also be found allowable.

Claims 80 and 81 were rejected under 35 U.S.C. § 103(a) as being unpatentable over US Patent No 5,657,400 to Granfors. Obviousness under § 103(a) requires that the patent relied on teach or suggest all of the elements of the rejected claim. Granfors fails to teach or suggest at least one element of Claim 80. Thus, rejection of Claim 80 as obvious in view of Granfors is improper.

Claim 80 recites "selecting which values to use to provide a value for the defective pixel for the first image based on a characteristic of the first image" and "selecting which values to use to provide a value for the defective pixel for the second image based on a characteristic of the second image." This combination of elements is not taught by Granfors. As discussed above with respect to Claim 76, Granfors fails to teach "selecting which values to use to provide a value for the defective pixel for the first image based on a characteristic of the first image," let alone also teach "selecting which values to use to provide a value for the

defective pixel for the second image based on a characteristic of the second image" as further recited in Claim 80.

Also, nothing in Granfors suggests selecting values in the manner claimed in Claim 80. Rather, Granfors clearly states that the pixels to use to correct the defective pixel are selected in a calibration phase. Col. 4, line 54 to Col. 5, line 5. This calibration phase is unrelated to the characteristics of a first image and the characteristics of a second image to be corrected. Further, the Office Action is silent as to why one of skill in the art would have been motivated to modify Granfors in a way that is not taught by Granfors.

Since Claim 80 recites at least one element not taught or suggested by Granfors, rejection of Claim 80 as obvious over Granfors is improper. Claim 81 depends from Claim 80 and rejection of Claim 81 as obvious over Granfors is improper for at least the same reasons as Claim 80.

CONCLUSION

In view of the foregoing, Appellants submit that the claims are not properly rejected as being unpatentable under 35 U.S.C. §102(a) or under 35 U.S.C. §103(a) over the cited references. Accordingly, it is respectfully requested that the board reverse the claim rejections and indicate that a Notice of Allowance respecting all pending claims be issued.

Respectfully submitted,

Date Nov. 15, 2004 By [signature]

FOLEY & LARDNER LLP
Customer Number: 33679
Telephone: (414) 297-5839
Facsimile: (414) 297-4900

Marcus A. Burch
Attorney for Applicant
Registration No. 52,673

Claims Appendix

1. A method for correcting a defective pixel in an image produced by a detector, the image including an array of pixels and the array of pixels having a corresponding array of pixel values, comprising:

(a) determining a local gradient, the local gradient comprising an array of local gradient matrix elements; and

(b) providing a correction value based on the local gradient to correct the defective pixel;

wherein at least a portion of the array of pixel values comprises a matrix, and includes the defective pixel as a center matrix element and each surrounding neighboring pixel of the defective pixel as additional matrix elements.

2. The method of claim 1, wherein step (a) of determining a local gradient includes determining the local gradient in part from a gradient kernel and at least a portion of the array of pixel values.

3. (Cancelled)

4. The method of claim 2, further comprising:

selecting a matrix size of the at least a portion of the array of pixel values; and

selecting the gradient kernel from a group including a Laplacian of a Gaussian filter kernel, a Roberts gradient kernel, a Prewitt gradient kernel, and a Sobel gradient kernel.

5. A method for correcting a defective pixel in an image produced by a detector, the image including an array of pixels and the array of pixels having a corresponding array of pixel values, comprising:

(a) determining a local gradient, the local gradient comprising a plurality of local gradient matrix elements; and

(b) providing a correction value based on the local gradient to correct the defective pixel;

wherein step (b) of providing a correction value includes at least one of a linear interpolation and a weighted average of pixel values corresponding to pixels selected based on a determination that they had the highest local gradient.

6. The method of claim 5, wherein the highest local gradient matrix elements include at least three highest local gradient matrix elements.

7. The method of claim 5, wherein the weighted average of pixel values having the highest local gradient matrix elements include giving greater weight to pixel values proximate to the defective pixel.

8. A method for correcting a defective pixel in an image produced by a detector, the image including an array of pixels and the array of pixels having a corresponding array of pixel values, comprising:

(a) determining a local gradient, the local gradient comprising a plurality of local gradient matrix elements;

(b) providing a correction value based on the local gradient to correct the defective pixel

identifying the defective pixel in the image produced by the detector before the determining step (a);

replacing the defective pixel with a temporary value based on a linear interpolation of surrounding neighboring pixels of the defective pixel before the determining step (a) such that determining the local gradient comprises determining the local gradient using the temporary value of the defective pixel; and

replacing the defective pixel with the correction value after the providing step (b).

9. The method of claim 1, further comprising repeating steps (a)-(b) a plurality of times as desired to correct a plurality of defective pixels in the image produced by the detector.

10. A system for correcting a defective pixel in an image produced by a detector, comprising:

a processor coupled to the detector, the processor configured to determine a local gradient and to generate a correction value based on the local gradient, wherein the image includes an array of pixels, each pixel having a corresponding pixel value, and the local gradient comprising an array of local gradient matrix elements;

wherein the at least a portion of the array of pixel values comprises a matrix, and includes the defective pixel as a center matrix element and each surrounding neighboring pixel of the defective pixel as additional matrix elements.

11. The system of claim 10, wherein the processor is configured to determine the local gradient partly from a gradient kernel and at least a portion of the array of pixel values.

12. (Cancelled)

13. The system of claim 11, further comprising an operator console coupled to the processor and configured to select a matrix size of the at least a portion of the array of pixel values and to select the gradient kernel from a group including a Laplacian of a Gaussian filter kernel, a Roberts gradient kernel, a Prewitt gradient kernel, and a Sobel gradient kernel.

14. The system of claim 10, wherein the correction value comprises at least one of a linear interpolation and a weighted average of pixel values corresponding to pixels selected based on a determination that they had the highest local gradient.

15. The system of claim 14, wherein the highest local gradient matrix elements include at least three highest local gradient matrix elements.

16. The system of claim 15, wherein the weighted average of pixel values having the highest local gradient matrix elements include providing greater weight to pixels proximate to the defective pixel.

17. The system of claim 10, wherein the detector comprises an array of photodetector elements, each photodetector element configured to convert an impinging photonic energy into an electrical signal proportional thereto.

18. The system of claim 10, wherein the processor is configured to determine the local gradient and to generate the correction value for each of a plurality of defective pixels in the image produced by the detector.

19. A system for correcting a defective pixel in an image produced by a detector, the image including an array of pixels, the array of pixels having a corresponding array of pixel values, comprising:

(a) means for determining a local gradient, the local gradient comprising an array of local gradient matrix elements; and

(b) means for providing a correction value based on the local gradient to correct the defective pixel.

20. The system of claim 19, wherein the local gradient is determined in part from a gradient kernel and at least a portion of the array of pixel values.

21. The system of claim 20, wherein the at least a portion of the array of pixel values comprises a matrix, and includes the defective pixel as a center matrix element and a surrounding neighboring pixels of the defective pixel as remaining matrix elements.

22. The system of claim 20, further comprising means for selecting a matrix size of the at least a portion of the array of pixel values and means for selecting the gradient kernel from a group including a Laplacian of a Gaussian filter kernel, a Roberts gradient kernel, a Prewitt gradient kernel, and a Sobel gradient kernel.

23. The system of claim 19, wherein the correction value comprises at least one of a linear interpolation and a weighted average of pixel values corresponding to pixels selected based on a determination that they had the highest local gradient.

24. The system of claim 23, wherein the highest local gradient matrix elements include at least three highest local gradient matrix elements.

25. The system of claim 23, wherein the weighted average of pixel values having the highest local gradient matrix elements include providing greater weight to pixels proximate to the defective pixel.

26. The system of claim 19, wherein the means for determining and the means for providing include determining the local gradient and generating the correction value, respectively, for each of a plurality of defective pixels in the image produced by the detector.

27. The system of claim 19, further comprising:

means for replacing temporarily the defective pixel with a temporary value based on a linear interpolation of a surrounding neighboring pixels of the defective pixel before the determining step (a) such that determining the local gradient comprises determining the local gradient using the temporary value of the defective pixel; and

means for replacing the defective pixel with the correction value.

28. The system of claim 27, wherein the means for replacing includes at least one of replacing the defective pixel with the correction value, and storing the correction value with an identifying link to the defective pixel in a storage device.

29. A method for correcting a defective pixel in an image produced by a digital x-ray detector, the image including an array of pixels and the array of pixels having a corresponding array of pixel values, the method comprising:

acquiring an image from the digital x-ray detector;

determining a local gradient, the local gradient comprising an array of local gradient matrix elements; and

providing a correction value, which is based on the local gradient, to correct the defective pixel;

wherein the at least a portion of the array of pixel values comprises a matrix, and includes the defective pixel as a center matrix element and each surrounding neighboring pixel of the defective pixel as additional matrix elements.

30. The method of claim 29, wherein determining a local gradient includes determining the local gradient in part from a gradient kernel and at least a portion of the array of pixel values.

31. The method of claim 30, wherein the at least a portion of the array of pixel values comprises a matrix, and includes the defective pixel as a center matrix element and a surrounding neighboring pixels of the defective pixel as remaining matrix elements.

32. The method of claim 30, further comprising:

selecting a matrix size of the at least a portion of the array of pixel values; and

selecting the gradient kernel from a group including a Laplacian of a Gaussian filter kernel, a Roberts gradient kernel, a Prewitt gradient kernel, and a Sobel gradient kernel.

33. The method of claim 29, wherein the correction value comprises at least one of a linear interpolation and a weighted average of pixel values corresponding to pixels selected based on a determination that they had the highest local gradient.

34. The method of claim 33, wherein the highest local gradient matrix elements include at least three highest local gradient matrix elements.

35. The method of claim 33, wherein the weighted average of pixel values having the highest local gradient matrix elements include giving greater weight to pixel values proximate to the defective pixel.

36. The method of claim 29, further comprising:

identifying the defective pixel in the image produced by the detector before determining a local gradient;

temporarily replacing the defective pixel with a temporary value based on a linear interpolation of a surrounding neighboring pixels of the defective pixel before determining a local gradient) such that determining the local gradient comprises determining the local gradient using the temporary value of the defective pixel; and

replacing the defective pixel with the correction value.

37. A method for correcting a defective pixel in an image produced by an x-ray detector having a defective input at the pixel, the image including an array of pixels and the pixels having corresponding pixel values, the method comprising:

receiving the image from the x-ray detector;

analyzing global characteristics of pixels in proximity to the defective pixel; and

correcting the defective pixel based on the global characteristics.

38. The method of claim 37, wherein the pixels in proximity to the defective pixel whose global characteristics are analyzed include at least a few pixels that are within a three pixel radius of the defective pixel, and that do not border the defective pixel.

39. The method of claim 38, wherein analyzing global characteristics of pixels in proximity to the defective pixel comprises determining gradient pixel values of pixels in proximity to the defective pixel.

40. The method of claim 39, wherein correcting the defective pixel based on the global characteristics comprises determining a correction value for the defective pixel using the gradient pixel values of pixels in proximity to the defective pixel.

41. The method of claim 38, wherein the pixels surrounding the defective pixel whose global characteristics are analyzed include at least those pixels within a 5 by 5 array where the defective pixel is at a center of the array.

42. The method of claim 41, wherein analyzing global characteristics of pixels in proximity to the defective pixel comprises analyzing characteristics of an array made of about seven columns and about seven rows of pixels, where the defective pixel is at a center of the array.

43. The method of claim 37, wherein the pixels in proximity to the defective pixel whose global characteristics are analyzed include at least those pixels that are not defective and that are within a three pixel radius of the defective pixel.

44. A method for correcting a defective pixel in an image produced by a digital detector having a defective input at the defective pixel, the image including an array of pixels and the pixels having corresponding pixel values, the method comprising:

analyzing a characteristic of each of a plurality of pixels;

selecting a first pixel of the plurality of pixels having a first pixel value based on the analyzed characteristic of the first pixel;

selecting a second pixel of the plurality of pixels having a second pixel value based on the analyzed characteristic of the second pixel;

selecting a third pixel of the plurality of pixels having a third pixel value based on the analyzed characteristic of the third pixel; and

providing a pixel value for the defective pixel using the first, second, and third pixel values;

wherein the first pixel, the second pixel, and the third pixel selected may be different for each image.

45. The method of claim 44, wherein the analyzed characteristic comprises a gradient of the pixel being analyzed.

46. The method of claim 45, wherein determining the gradient for each pixel includes temporarily replacing the pixel value of the defective pixel with a calculated pixel value.

47. The method of claim 45, wherein the provided pixel value comprises a linear average of pixel values from pixels that are not defective.

48. The method of claim 45, wherein the gradient for each pixel is determined by at least one of a Laplacian of a Gaussian filter kernel, a Roberts gradient kernel, a Prewitt gradient kernel, and a Sobel gradient kernel.

49. The method of claim 45, wherein the gradient for each pixel is determined by $G_i = \sqrt{(A_i * H)^2 + (A_i * (-H))^2}$ where A_i is a matrix of pixel values comprising the image and H is a gradient kernel matrix.

50. The method of claim 45, wherein the first, second, and third pixels are selected based on having a highest gradient value of the plurality of pixels that are analyzed.

51. The method of claim 44, wherein providing a pixel value for the defective pixel using the first, second, and third pixel values comprises averaging the pixel values used to provide a pixel value for the value of the defective pixel.

52. The method of claim 51, wherein averaging the pixels values comprises using a linear average of the pixel values.

53. The method of claim 51, wherein averaging the pixels values comprises using a weighted average of the pixel values.

54. The method of claim 53, wherein a weight assigned to each pixel value used to provide the pixel value of the defective pixel is based on a characteristic used to select the pixel to be used to provide a value for the defective pixel.

55. The method of claim 53, wherein a weight assigned to each pixel value used to provide the pixel value of the defective pixel is based on a proximity of the pixel to be used to provide a value for the defective pixel to the defective pixel.

56. The method of claim 44, wherein the first, second, and third pixels are further selected based on whether they border the defective pixel in the array of pixels.

57. The method of claim 44, wherein the analyzed characteristic of the plurality of pixels are calculated based on pixel values of the pixels.

58. The method of claim 44, wherein the characteristic analyzed comprises a characteristic selected from a group consisting of edge strength, gradient strength, and image feature strength.

59. The method of Claim 76, wherein:

the first image is received from an x-ray detector; and

selecting which values to use to provide a value for the defective pixel for the first image based on a characteristic of the first image comprises,

analyzing a characteristic of each of a plurality of pixels, the characteristic for each of the plurality of pixels based on pixel values of the first image;

selecting a first pixel of the plurality of pixels having a first pixel value based on the analyzed characteristic of the first pixel;

selecting a second pixel of the plurality of pixels having a second pixel value based on the analyzed characteristic of the second pixel; and

providing a pixel value for the defective pixel for the first image using the first and second pixel values.

60. The method of claim 59, wherein the analyzed characteristic comprises a gradient of the pixel being analyzed.

61. The method of claim 60, wherein determining the gradient for each pixel includes temporarily replacing the pixel value of the defective pixel with a calculated pixel value.

62. The method of claim 61, wherein the calculated pixel value is a linear average of pixel values from pixels that are not defective.

63. The method of claim 60, wherein the gradients for the first and second pixels are determined by at least one of a Laplacian of a Gaussian filter kernel, a Roberts gradient kernel, a Prewitt gradient kernel, and a Sobel gradient kernel.

64. The method of claim 60, wherein the gradient for the first and second pixels are determined by applying $G_i = \sqrt{(A_i * H)^2 + (A_i * (-H))^2}$ where A_i is a matrix of pixel values comprising the image and H is a gradient kernel matrix.

65. The method of claim 60, wherein the first and second pixels are selected based on having a highest gradient value of the plurality of pixels that are analyzed..

66. The method of claim 59, wherein providing a value for the defective pixel using values of a plurality of pixels comprises averaging pixel values used to provide a pixel value for the defective value.

67. The method of claim 66, wherein averaging the pixels values comprises using a linear average of the pixel values.

68. The method of claim 66, wherein averaging the pixels values comprises using a weighted average of the pixel values.

69. The method of claim 68, wherein a weight assigned to each pixel value used to provide the pixel value of the defective pixel is based on the characteristic used to select the pixel to be used to provide a value for the defective pixel.

70. The method of claim 68, wherein a weight assigned to each pixel value used to provide the pixel value of the defective pixel is based on a proximity of the pixel to be used to provide a value for the defective pixel to the defective pixel.

71. The method of claim 59, wherein the first and second pixels are selected such that they border the defective pixel in the array of pixels.

72. The method of claim 71, wherein the characteristic analyzed comprises a characteristic selected from a group consisting of edge strength, gradient strength, and image feature strength.

73. The method of claim 59, further comprising displaying the image to a user, wherein the displayed image comprises the first pixel value, the second pixel value, and the pixel value provided for the defective pixel.

74. The method of claim 59, further comprising repeating a process of analyzing a characteristic of each of a plurality of pixels, the characteristic for each of the plurality of pixels based on pixel values; selecting a first pixel of the plurality of pixels having a first pixel value based on the analyzed characteristic of the first pixel; selecting a second pixel of the plurality of pixels having a second pixel value based on the analyzed characteristic of the second pixel; and providing a pixel value for the defective pixel using the first and second pixel values for each of the defective pixels of the digital detector.

75. The method of claim 59, further comprising determining which pixels of the digital detector are defective before an image to be corrected is received from the digital detector.

76. A method for correcting a defective pixel in an image produced by a detector having a defective input at the pixel, the image including an array of pixels and the pixels having corresponding pixel values, the method comprising:

receiving a first image from the detector; and

selecting which values to use to provide a value for the defective pixel for the first image based on a characteristic of the first image.

77. The method of claim 76, wherein the characteristic of the first image comprises gradient values of a plurality of pixels in the first image, the plurality of pixels neighboring the defective pixel.

78. The method of claim 77, further comprising providing the value for the defective pixel for the first image; and wherein providing the value for the defective pixel for the first image includes at least one of a linear interpolation and a weighted average of pixel values corresponding to pixels selected based on a determination that they had highest local

gradients of the gradient values of the plurality of pixels in the first image neighboring the defective pixel.

79. The method of claim 77, wherein the gradient values of the plurality of pixels in the first image neighboring the defective pixel are determined by a process comprising replacing the defective pixel with a temporary value, the temporary value based on values of neighboring pixels of the defective pixel.

80. The method of claim 76, further comprising,

receiving a second image from the detector; and

selecting which values to use to provide a value for the defective pixel for the second image based on a characteristic of the second image.

81. The method of claim 80, wherein the characteristic of the first image comprises image features of the first image and the characteristic of the second image comprises image features of the second image.